Advisory Report

September 25, 2013

Key Findings:

- Cost and energy savings are well-documented across the country in communities that pursue use of alternative fuel sources, including but not limited to propane and compressed natural gas (CNG) fleets.
- Governmental entities in the County are uniquely situated to expand their propane and CNG fleets, as some jurisdictions have already pursued propane and CNG options and developed arrangements for necessary but costly fueling infrastructures.
- The CEC recommends that the larger jurisdictions within the county continue or initiate, as appropriate, alternative fuel conversion programs for their light-duty and heavy-duty fleet vehicles.
- The CEC further recommends that jurisdictions research the viability of cooperative alternative fuel fleet conversions in order to minimize the up-front capital costs of alternative fuel conversions.
- The CEC has provided educational resources and identified potential funding opportunities in this recommendation.

The Citizens' Efficiency Commission
Room 212
200 South 9th Street
Springfield, Illinois 62701
Phone: 217.535.3110
Fax: 217.535.3111
CitizensEfficiency@gmail.com
http://www.sscrpc.com

Citizens' Efficiency Commission Recommendation:

Expand Existing Use of Alternative Fuels in Local Government Fleets

Introduction

This report represents a formal recommendation by the Citizens' Efficiency Commission (CEC). Members of the CEC and its research staff have validated information contained in this report. The Commission expresses its hope that relevant local leaders will review the recommendation and take strides toward its implementation.

In light of the research presented below, the CEC recommends that the larger jurisdictions within the county continue or initiate, as appropriate, alternative fuel conversion programs for their light-duty and heavy-duty fleet vehicles, particularly as normal vehicle turnover presents opportunities to do so. The CEC further recommends that jurisdictions research the viability of cooperative alternative fuel fleet conversions in order to minimize the up-front capital costs of alternative fuel conversions.

The Commission is prepared to provide assistance to the greatest extent possible for the review and implementation of these recommendations. The CEC may be interested in further efficiency considerations that develop based on this advisory report.

Background Information

As follow-up to the garage consolidation efforts of the City of Springfield and Sangamon County,[1] the CEC felt it valuable to consider other available cost and energy savings opportunities related to fleet management and maintenance, as fleets tend to represent large cost centers for local governments. Early in its work, the CEC expressed commitment to the "Six C's of Citizens' Efficiency," which suggest that efficiency and effectiveness should be pursued both within and across jurisdictional lines. The CEC is also aware of noteworthy savings at the City of Springfield and the Springfield Mass Transit District (SMTD), related to the conversion of parts of their fleets to compressed natural gas (CNG) or propane autogas (propane) vehicles.

Building upon its previous recommendation pertaining to energy efficiency programs,[2] the CEC therefore identified the subject of alternative fuel sources for municipal and special district fleets as the focus of a regional recommendation. To this effect, members of Public Works Committee of the CEC presented the following finding to the CEC at its May 2013 meeting, and received approval to further investigate the validity of the use of alternative

[1] See: CEC. (September 12, 2012). "Positive Local Efforts Applauded by the Citizens' Efficiency Commission." Available at: http://www.co.sangamon.il.us/Departments/RegionalPlanning/documents/CEC/Positive%20Local%20Efforts%20Document.pdf

[2] Citizens' Efficiency Commission. (February 13, 2013). "Utilize Existing Energy Efficiency Funds for Facility Upgrades." Available at: http://www.co.sangamon.il.us/Departments/RegionalPlanning/documents/CEC/Energy %20Efficiency% 20Program%20Recommendation.pdf.

fuel sources in the region as well as potential federal and state funding sources.

> *Rising costs of motor fuel and the national dialogue on reducing emission of greenhouse gases has led to technological innovations in the area of alternative vehicle fuels. Liquefied Petroleum Gas (LPG or propane) and Compressed Natural Gas (CNG) systems offer more affordable alternatives to traditional motor fuel for some vehicles. Some local entities have already begun to explore opportunities for fleet renewal or conversion so that they may take advantage of these savings, along with associated grants and tax incentives for alternative fuel conversions. The Public Works committee requests the full support of the CEC to review benefits and drawbacks to these alternative fuel sources, with a goal of encouraging local governments to take advantage of savings appropriate to their fleets, and identifying opportunities to expand savings and increase cross-jurisdictional coordination in these efforts.*

Efficiency Research Questions

As it pursued its research related to this finding, the CEC asked questions such as:

- What are currently used & effective alternative fuel sources?
- What are the costs associated with these alternative fuel sources?
- What are the savings which the implementation of these alternative fuel sources could provide?

Overview of Alternative Fuel Sources & Existing Services

Within the Sangamon County region, the CEC is primarily aware of the City of Springfield and the Springfield Mass Transit District (SMTD) as the largest current users of alternative fuel sources within their fleets. Currently, the rest of the governmental entities within the county continue to rely on traditional motor-fueled fleets for their service needs. Since some local familiarity and infrastructure surrounding propane and CNG as alternative fuel sources already exists, this educational recommendation emphasizes the basics of these two alternative fuel sources. The efforts of the City of Springfield and SMTD are highlighted as illustrations for other localities and special districts considering alternative fuel implementation. Furthermore, aside from propane and CNG, there exists a range of alternative fuel sources that, while less popular and cost-efficient for municipal fleet conversions, still form an important part of alternative fuel considerations for local governments. These fuel sources, including biodiesel, ethanol, and electricity, have been briefly examined as well.

Propane Autogas: The Basics[3]

Propane autogas, also known as liquefied petroleum gas and more commonly referred to as propane, has been used in vehicles since the early 20th century. While few vehicle manufacturers operating in the United States produce propane-fueled *vehicles*, liquid propane injection engines for retrofitted use in a number of manufacturers' existing vehicles were introduced in 2006, and are intended to increase fuel economy over comparative gasoline-fueled engines.

This being the case, most vehicles with propane engines are converted from gasoline engines. This retrofit can be completed by certified installers on most light- to heavy-duty vehicles for

[3] United States Department of Energy; Energy Efficiency & Renewable Energy. 2013. Energy Basics, Vehicle Fuels. "Propane Vehicles." Available at: http://www.eere.energy.gov/basics/vehicles/propane_vehicles.html.

anywhere from $4,000 to $12,000.[4] Some converted vehicles are propane only. However, there are conversion kits which allow for bi-fuel options. These engines use propane as the primary fuel source, but have access to a reserve tank of gasoline if the propane tank empties prior to refueling.

Propane Summary

Potential Benefits:
-fuel savings range from $.050 to $1.75 per gallon
-maintains power, acceleration, and cruising speeds
-lower engine maintenance cost
-no cold start issues
-extra storage tanks can be carried
-lower fueling station costs
-tax incentives may further reduce costs
-reduces greenhouse gas emissions

Potential Drawbacks:
-25% lower energy content reduces range
-additional weight in vehicle may change handling
-additional employee training needed for fueling

When to use propane:
-when fueling stations are already in place or can be subsidized
-when grant or tax incentive funding makes up-front capital costs for conversions affordable
-for larger-scale conversions of lighter fleets

The power, acceleration, and capable cruising speeds of propane-powered vehicles are very similar to those of traditionally-fueled engines. Though bi-fuel engines have mileage ranges comparable to traditional gasoline-fueled vehicles, converted propane engines typically have a smaller range due to the nearly 25% lower energy content of propane itself and the inherently less efficient nature of the converted gasoline-injected engine. Unlike traditional gasoline-fueled engines, propane-fueled vehicles have the ability to carry extra storage tanks to increase the vehicles range. It is important to note that the increased weight of the vehicle associated with these fuel tanks affects the range capacity of the engine as well.

Another reason for the increasing popularity of propane-fueled vehicles is the lower cost of engine maintenance over time. Propane contains a 16-18% higher octane rating as well as fewer carbon and oil contaminants than gasoline, which has proven to result in an engine lifetime that is up to two times longer than those of gasoline-fueled engines. Cold starts are also a non-issue with propane engines as the fuel mixture is completely gaseous in nature and not susceptible to freezing.

Overall potential cost savings from the use of propane-fueled engines varies. It is important to note that propane is a gasoline-based product and as such is subject to price fluctuations associated with the petroleum industry. Typically, lighter-duty vehicles and large scale propane fleet conversion programs result in higher savings.[5] While upfront costs could be considered high, the average break-even point for return on investment, depending on whether or not a propane filling station is installed, ranges from 18 months to 3 years.[6] Savings on fuel range from $0.50 to $1.75 per gallon as compared to current traditional fuel prices.[7] Some tax incentives currently exist for propane fuel as well and are further detailed below.

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[4] United States Department of Energy; Energy Efficiency & Renewable Energy. 2013. Alternative Fuels Data Center, Fuels & Vehicles, Propane. "Propane Vehicle Conversions." Available at: http://www.afdc.energy.gov/vehicles/propane_conversions.html.
[5] Throughout this recommendation document, the CEC discusses both traditional gasoline and diesel as comparable traditional fuel sources. Where appropriate, comparative cost information for both fuel types has been listed separately. At times, the CEC has considered only gasoline as a comparable fuel source in calculating comparative savings ranges because the vehicle types in question are more commonly non-diesel.
[6] United States Department of Energy; Energy Efficiency & Renewable Energy. 2013. Alternative Fuels Data Center, Fuels & Vehicles, Propane. "Propane Benefits and Considerations." Available at: http://www.afdc.energy.gov/fuels/propane_benefits.html.
[7] Ibid 10, 12, 13.

Local Example: Propane Fleet Conversions in the City of Springfield

In May of 2013, the City of Springfield put 24 propane bi-fueled vehicles, among them police cruisers and city fleet pickup trucks, into operation.[8] The City opted for bi-fuel capable conversion kits in its transition. The City received $4,000 per vehicle from the Illinois Environmental Protection Agency and $4,000 per vehicle in matching federal grant funding. The City is also investigating a $0.50/gallon tax credit for propane fuel.

The City's propane conversions are being performed with conversion kits and manpower from Clean Fuel USA. Clean Fuel provides an employee to perform conversions within the City's facilities and train employees on fueling the vehicles. The kits are available for the City's existing police cruisers and public works pick-up trucks. The fuel tank sits in the vehicles trunk, with a special fueling nozzle. The vehicles can be switched from propane to traditional fuel automatically via an internal computer system or manually by a switch installed on the vehicle's dashboard. City staff indicate that they have found the bi-fuel propane vehicles to handle well and have comparable, if not improved, accelerating and cruising capabilities. Moreover, City staff expressed satisfaction with the vehicle safety components, including a double valve feature to prevent leaks.

Fueling for these vehicles will be done at a propane fueling station provided through Lincoln Land FS, a local firm which provides fueling services to agricultural vehicles. This public-private relationship is expected to save the city the costs of constructing and installing a propane fuel pump, which in other jurisdictions has typically required expenditures averaging $106,000.[9] The City indicates that there will be some soft costs for an annual employee training for propane fueling recertification.

The City expects notable savings in terms of maintenance costs, because of the reduced wear and tear on engines typically associated with propane's reduced carbon and oil contaminants . The City expects more than $82,000 in annual fuel and maintenance savings in the first year alone for the current 24 propane-converted vehicles.[10]

Compressed Natural Gas: The Basics[11]

There are three types of natural gas-fueled engines with three fuel sources: natural gas vehicles (NGVs) converted from gasoline-fueled engines to those fueled by either liquefied natural gas or CNG; dedicated NGVs designed and manufactured to run on either form of natural gas; and finally, engines that are bi-fuel compatible, not unlike the propane bi-fuel system where traditional fuel is used as a backup to the primary natural gas fuel. The CEC emphasized bi-fuel and dedicated NGVs fueled by compressed natural gas (CNG) in its research, as the literature indicates that they generally demonstrate better performance and generate fewer greenhouse gas emissions.

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[8] Personal communication from William McCarty, Budget Director, City of Springfield (April 30, 2013).
[9] United States Department of Energy; Energy Efficiency & Renewable Energy. 2013. Alternative Fuels Data Center, Fuels & Vehicles, Propane. "Propane Fueling Infrastructure Development." Available at: http://www.afdc.energy.gov/fuels/propane_infrastructure.html.
[10] Government Fleet. 2013. "Springfield, Ill., Converts 24 Vehicles to Propane Autogas." Available at: http://www.government-fleet.com/channel/green-fleet/news/story/2013/05/springfield-ill-converts-24-vehicles-to-propane-autogas.aspx?prestitial=1; Personal communication from William McCarty, Director of the Office of Budget and Management, City of Springfield. April 25 & 30, 2013.
[11] United States Department of Energy; Energy Efficiency & Renewable Energy. 2013. Energy Basics, Vehicles & Fuels. "Natural Gas Vehicles." Available at: http://www.eere.energy.gov/basics/vehicles/natural_gas_vehicles.html.

CNG-fueled vehicles experience longer service lives and lower maintenance costs than traditional fuel engines; most engine service and maintenance lasts two or three times longer than comparable service and maintenance on gasoline-fueled engines. CNG engines emit far fewer emissions than traditional gasoline or diesel engines. It should be noted, however, that CNG when released *directly* into the atmosphere is considered a greenhouse gas. CNG engines also run more cleanly, which adds to the overall engine life.

In April of 2013 national average fuel costs for CNG were $2.10 per gasoline gallon equivalent (GGE), as compared to a traditional gasoline national average of $3.59 and a traditional diesel national average of $3.99.

There are typically larger up-front costs for converting vehicles to CNG-fueled engines. The cost of retrofitting a gasoline engine to CNG ranges from $10,000 to $12,000 for light-duty vehicles, such as cars and lightweight pickups, and up to $50,000 for heavy-duty vehicles such as transit buses or refuse trucks. In late 2012 companies such as Chrysler began manufacturing and selling CNG- and bi-fueled Dodge RAM trucks to private buyers as well as to fleet procurers.[12] Buying vehicles off the line that are CNG-fueled lowers the overall costs of fleet conversion, if done when replacement vehicles are needed.

Building a CNG filling station requires more substantial upfront investment than traditional filling stations or even propane filling stations. On average, the installation of a CNG filing station costs over $1.5 million. CNG fueling station installation costs vary based on the type of fueling station, time-fuel or fast-fuel. While time-fuel stations work well for larger fleets generally by fueling vehicles directly from a compressor, fast-fuel stations compress natural gas and store it in tanks for quicker fueling times more appropriate to light-duty or fueling patterns that are not regularly scheduled. While there are grants, loans, and subsidies for CNG conversions of service fleets, communities typically are responsible for a substantial portion of the cost of installation. Additional costs may include modifications to maintenance facilities, the availability of backup fueling stations, and future station upgrades if expansion is not accounted for in the initial design process.

CNG Summary

Potential Benefits:
-fuel savings of approximately $1.00-$2.00 per gasoline gallon equivalent
-lower engine maintenance cost
-tax incentives may further reduce costs
-reduced greenhouse gas emissions

Potential Drawbacks:
-large upfront costs for vehicle conversion
-substantial capital costs for fueling stations
-potential increases in maintenance costs due to compliance and safety requirements

When to use CNG:
-when fueling stations are already in place or can be subsidized
-when grant or tax incentive funding makes up-front capital costs for conversions affordable
-for heavier vehicles
-on a gradual basis as fleet vehicles are replaced with CNG vehicles, rather than converted

Local Example: CNG Buses at the Springfield Mass Transit District

In October of 2001, the SMTD was the first transit agency in the state to receive the Illinois Green Fleet Designation as a 5-star fleet from the Illinois Environmental Protection Agency for its use of

[12] Government Fleet. 2012. "Chrysler Begins Production of Ram 2500 CNG Pickup Truck." Available at: http://www.government-fleet.com/channel/green-fleet/news/story/2012/10/chrysler-begins-production-of-ram-2500-cng-pickup-truck.aspx.

three types of environmentally-friendly alternative fuel sources, one of which is CNG.[13] According to the SMTD, 28 of its 56 buses have been equipped with CNG engines.[14] The SMTD will also be acquiring 7 new buses in the coming year, and half of these buses will be CNG vehicles. On site, the SMTD has owned and operated a CNG fueling station for a number of years. The SMTD is currently in the process of constructing an expanded fueling station, which will have a fast-fill port. Estimated costs for this fueling station are approximately $2 million.

The primary cost centers related to SMTD's CNG fleet include these overhead capital costs for the fueling station, the approximately $50,000 higher cost per vehicle as compared to diesel transit buses, and the more expensive parts and filters. These costs are countered by the reduced fuel costs incurred for CNG vehicles, the existing federal tax credit of $0.50/GGE, and minimal maintenance savings.

As a result of the costs and savings described above, on average, the SMTD reports that its use of CNG vehicles is roughly cost-neutral as compared to its diesel buses. Aside from cost efficiency, other benefits are accrued as a result of having a mixed CNG and diesel fleet. The SMTD no longer has single-fuel dependency. Mileage can be spread across the different types of vehicles in its fleet and a more regular replacement schedule can be implemented. The CNG vehicles also provide environmental benefits. Finally, the SMTD anticipates that, as domestic natural gas production may increase in future years, fuel costs could be reduced. The SMTD anticipates that its new fueling station will have the capacity to service other local jurisdictions' vehicles, and could eventually represent a revenue-generator.

Additional Alternative Fuels: Basic Information

Although propane and CNG are the most commonly utilized alternative fuels for municipal fleets due to their cost efficiency and appropriateness for governmental fleet needs, a number of other alternative fuels exist that merit consideration give that they are often mentioned.

Biodiesel

Biodiesel is an alternative fuel source that should not be confused with petroleum diesel gasoline. Biodiesel is comprised of the glycerin from fats and oils, and is biodegradable as well as nontoxic. Biodiesel can be made from such source materials as recycled cooking oil, soybean oil, and animal fats. It reduces greenhouse gas emissions by 57-86% compared to petroleum diesel, and reportedly supplies over 50,000 nationwide jobs annually.[15]

On average, pure biodiesel is approximately 10% less efficient in terms of fuel economy, while biodiesel/petroleum diesel blends are approximately 2% less efficient.[16] In terms of national average fuel costs, biodiesel and blended biodiesel/diesel are slightly more expensive than petroleum gasoline. In early April 2013, petroleum diesel averaged $3.99/gallon nationally, with biodiesel was at $4.29/gallon and blended at $4.11/gallon.[17] Though it reduces environmental impact, biodiesel fuels typically are not more cost efficient than alternatives.

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[13] Springfield Mass Transit District (SMTD). 2013. "Illinois Green Fleet: SMTD Earns a 5-Star Green Fleet Rating." Available at: http://www.smtd.org/displayPage.asp?pID=10.
[14] Ibid. 9.
[15] Biodiesel: America's Advanced Biofuel. "Biodiesel Basics: What is biodiesel?" 2013. Available at: http://www.biodiesel.org/what-is-biodiesel/biodiesel-basics.
[16] United State Department of Energy, Energy Efficiency & Renewable Energy. "Biodiesel." 2013. Available at: http://www.fueleconomy.gov/feg/biodiesel.shtml.
[17] United State Department of Energy, Energy Efficiency & Renewable Energy. "Fuel Prices." 2013. Available at: http://www.afdc.energy.gov/fuels/prices.html.

It should also be noted that biodiesel does not typically require any sort of modification or change to the fueling system of the vehicle. Factory diesel engines are able to process biodiesel. However, biodiesel has a solvent effect on the deposits which form inside the tank and engines of the vehicle. This can cause filters to clog once the biodiesel is dispersed throughout the engine, but is solved by the replacement of the effected filter. Regular maintenance costs are typically similar to petroleum diesel engines.

Ethanol

Ethanol, currently known at the pump as E85, is also a local product in terms of alternative fuel sources. Illinois is the third largest producer of ethanol fuel, which supported more than 400,000 nationwide jobs in 2011.[18] Ethanol is made from plant materials known as "biomass" from such sources as trees, grasses, agricultural by-products, algae, etc. E85, the fuel currently available at gas stations, is actually a blend of 15% petroleum gasoline and 85% ethanol.
The price of ethanol varies from region to region. Regions where the contributing biomass is grown and ethanol is produced, such as the Midwest, tend to see cheaper prices than other regions of the country. As of early April 2013, ethanol cost approximately $3.30/gallon on national average.[19] While both biodiesel and ethanol are cheaper per gallon than petroleum gasoline, they do not provide the same level of energy per gallon. Once this lack in equivalent fuel economy is taken into consideration, these alternative fuels costs are on par with gasoline. The difference, at that point, is the reduced greenhouse gas emissions and environmental benefits.

According to the United States Department of Energy (DoE), performance of vehicles using ethanol is relatively on par with all-petroleum gasoline vehicles. Benefits of ethanol may include reduced dependence on petroleum sources, lower greenhouse gas emissions, and reduced vehicle maintenance costs as compared to traditional fuels. Disadvantages include the fact that only flex fuel vehicles are able to use ethanol, the lower energy content and fuel efficiency, and the currently limited ethanol fueling station availability. Ethanol is also currently more expensive to produce than petroleum gasoline.[20]

Alternative Fuels Summary

-Biodiesel and ethanol alternative fuel sources have benefits related to local production and reductions in greenhouse gas emissions, but may not always generate cost savings.

-Electric vehicles have benefits related to reduced maintenance and fueling costs, but range considerations and lack of charging infrastructure have prevented them from becoming widely used in governmental fleets.

-It is important to consider alternative fuels in light of fleet size and functional needs, and select alternatives based upon the most important policy preferences.

Electric

Electric vehicles (EVs) provide another fuel alternative available to jurisdictions. Most electric vehicles available today are hybrids; typically using an electric battery to power the engine

[18] United State Department of Energy, Energy Efficiency & Renewable Energy . "Ethanol Benefits and Considerations." 2013. Available at: http://www.afdc.energy.gov/fuels/ethanol_benefits.html.
[19] Ibid. 13.
[20] United State Department of Energy, Energy Efficiency & Renewable Energy. "Ethanol." 2013. Available at: http://www.fueleconomy.gov/feg/ethanol.shtml.

when starting, stopping, or cruising under a certain speed. In the case of the all-electric (with gasoline backup) Chevy Volt, for example, the vehicle functions on entirely electric capacity until the battery loses its charge after approximately 40 miles. These vehicles then switch to traditional petroleum gasoline to power their engines. When running completely on their electric battery, the vehicles produce zero emissions.[21] These engines also tend to run more cleanly over the long-term as they eliminate the need to cycle oil through the engine system.

The cost of charging electric batteries varies according to the time of day the vehicle is plugged into the power grid. During peak electricity times from mid-morning to early evening, the cost of charging an EV will be invariably higher than if it is charged overnight. Charging EVs also presents a challenge in terms charging station availability. Many private owners and municipalities are currently investing in the appropriate infrastructure to charge EVs, however public charging stations are currently limited as they are not considered a utility, but a public service or fringe benefit. Level 2 chargers, which require four to six hours to complete a full charge, are the fastest-charging, currently standardized stations in the country and recognized by the State of Illinois.

Nationwide Best Practices

Along with the City of Springfield, many communities across the country have converted vehicles in their service fleets to alternative fuels. Each community has reported significant per vehicle savings over traditional fuel engines, along with increased energy efficiency and greenhouse gas reductions. Communities in the process of converting vehicles within their fleets also expect marked savings going forward. The CEC has briefly documented the experiences of a number of these entities below.

Propane

Williamson County, Texas[22] (Population- U.S. Census Bureau: 422,679)

In 2009, Williamson County, located just north of Austin, Texas, began converting vehicles in their Emergency Medical Services, County Constable, and Parks Department fleets. As of April 2013, eight vehicles were 100% propane-fueled and another 26 were equipped with bi-fuel systems. Williamson County has installed six propane autogas fueling stations during this time as well. Per year, Williamson County expects to save $73,000 on fuel costs with its currently converted fleet.

Avon Lake, Ohio[23] (Population: 22,581)

In Ohio, the City of Avon Lake is currently in the process of converting 10 city vehicles to propane bi-fuel using a 10-year, zero-interest $48,600 loan from the State of Ohio. The city expects the fuel to cost them $1 to $1.50 less per gallon than gasoline. Initially, the city will be converting three police cruisers and two service vehicles before the end of 2013. In 2014, Avon Lake plans to convert an additional three vehicles, with each subsequent year seeing two vehicles converted until their service fleets are comprised of either propane-only or bifuel

[21] United State Department of Energy, Energy Efficiency & Renewable Energy. "Benefits and Considerations of Electricity as a Vehicle Fuel." 2013. Available at: http://www.afdc.energy.gov/fuels/electricity_benefits.html.
[22] Government Fleet. 2013. "Williamson County Fleet Saves $73K with Propane Autogas." Available at: http://www.government-fleet.com/channel/law-enforcement/news/story/2013/04/williamson-county-fleet-saves-73k-with-propane-autogas.aspx.
[23] The Morning Journal. 2013. "Avon Lake plans propane station to power city vehicles." Available at: http://www.morningjournal.com/articles/2013/06/07/news/doc51b15875e2a19073503692.txt.

vehicles. The city has also installed a fueling station for their fleets' use. As its conversion program progresses, the city has expressed its desire to help other area communities with developing propane conversion programs.

Sandy Springs, Georgia[24] (Population: 93,853)

Sandy Springs, Georgia, took advantage of support from the Southeast Propane Autogas Development Program (SPADP), an alternative fuel project funded by the American Recovery & Reinvestment Act and the DoE's Clean Cities Program, to convert 25 of its police cruisers to propane. Estimates place their overall fuel savings at $33,000 per year for the current 25 vehicles as well as eliminating over 30 tons of greenhouse gas emissions per year.
The City reports that as it saw its fuel budget double due to rising fuel costs, it recognized the need to find an alternative fuel source and implement a fueling strategy that eliminated reliance on traditional gasoline and move towards domestically available fueling options. As of August 2012, the City calculated its per gallon savings at approximately $1.70 as compared to traditional gasoline.

Mobile, Alabama[25] (Population: 195,111)

In the Police and Public Works Departments in Mobile, Alabama, over 60 vehicles have been converted to propane through a DOE grant. Mobile places its per gallon savings at $1.25 over gasoline. Many fleet operators are also reporting that the newly converted vehicles require less maintenance.

Temple, Texas[26] (Population: 66,102)

In early 2013, the City of Temple, Texas, received a grant through the DoE to convert 11 vehicles to propane-fueled engines. Each vehicle is expected to emit nearly 1,300 lbs less of greenhouse gas emissions and save $2,500 to $3,000 in fueling costs. The city indicates that it has moved towards a more efficient sustainability position after adopting a Sustainability Management Plan, which is designed not only to cut costs, but increase longevity of their investments. To that end, government officials in Temple expect alternative fuel conversions to aid in their sustainability improvements.

Compressed Natural Gas (CNG)

Norman, Oklahoma[27] (Population: 110,925)

Norman, Oklahoma, adopted a program in 2009 designed to make alternative fuel sources available in the face of rising gasoline prices. As of early 2012, the city had purchased seven

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[24] Government Fleet. 2012. "Sandy Springs Converts 25 Patrol Cars to Propane Autogas." Available at: http://www.government-fleet.com/channel/green-fleet/news/story/2012/08/sandy-springs-converts-25-patrol-cars-to-propane-autogas.aspx.
[25] Government Fleet. 2012. "Mobile PD Coverts 30 Vehicles to Propane Autogas." Available at: http://www.government-fleet.com/channel/fuel-management/news/story/2012/07/mobile-pd-converts-30-vehicles-to-propane-autogas.aspx.
[26] Government Fleet. 2013. "City of Temple, Texas, Transitioning Fleet to Propane Autogas." Available at: http://www.government-fleet.com/channel/fuel-management/news/story/2013/03/city-of-temple-texas-transitions-fleet-to-propane-autogas.aspx.
[27] Efficient Gov: For forward-thinking municipal leaders. 2012. "Oklahoma city saves with compressed natural gas." Available at: http://efficientgov.com/blog/2012/01/24/oklahoma-city-saves-with-natural-gas-station/.

CNG vehicles, all of which are considered heavy-duty: three refuse trucks, one field service truck, one SUV, one street cleaner, and one commercial-grade lawn mower. The city expects annual savings of at least $52,000 with natural gas costs at $1.44 per gallon. The city's filling station cost approximately $1.65 million. However, over half of those funds came from a State Commerce grant, and another $200,000 from a separatefleet conversion program grant.

Culver City, California[28] (Population: 38,883)

As of 2011, approximately 85% of the medium- and heavy-duty fleet vehicles in Culver City, California, ran on CNG, and as of early 2013, the city's CNG-fueled vehicles include refuse and public works trucks, standard autos, and buses. Culver estimates that this results in $1.2 million in gasoline savings for the city. The city is in the process of expanding current CNG filling stations.

Temple, Texas[29] (Population: 66,102)

In addition to its propane conversion efforts, Temple, Texas, is also in the process of replacing its heavy-duty waste truck fleet of 14 with 16 new CNG-fueled vehicles. The filling station is estimated to cost approximately $1.62 million. This decision was made after a feasibility study commissioned by the Temple City Council prediction a positive return on investment within only 7.5 years along with significant fuel savings.

Columbus, Ohio[30] (Population: 787,033)

In 2012, Columbus, Ohio, opened its first CNG filling station for municipal, private companies, and private individuals to use. By the end of 2013, the city expects to have more than 50 CNG vehicles in service, reducing the city's gasoline costs by more than $9,000 per vehicle, per year. The city also eliminated the equivalent of over 1,000 cars' worth of emissions per year.

Additional Alternative Fuels

Biodiesel, ethanol, and electric are all three additional alternative fuel sources which have had local applications. Currently, biodiesel is employed by over 5,595 fleet vehicles in the State of Illinois, as reported by Illinois Green Fleets. Local or near local examples include: the Ball-Chatham School District, which has 24 biodiesel school buses in its fleet; Peoria's Mass Transit District, which has 86; and the Riverton School District, which has 13.[31].

While EVs are generally not considered a popular option for municipal fleet vehicles due to range limitations, there are local examples of jurisdictions undertaking initiatives to help make EV charging stations available to local users. By law, EV charging stations cannot be considered a utility. Instead, they are treated as a public service by municipalities or a fringe benefit by

[28] Governing: The States and Localities. 2011. "Investing in Greener Fleets During Tough Times." Available at: http://www.governing.com/topics/energy-env/Investing-Greener-Fleets-Tough-Times.html.
[29] Government Fleet. 2013. "Temple, Texas to Build CNG Station and Convert Solid Waste Fleet to Natural Gas." Available at: http://www.government-fleet.com/channel/fuel-management/news/story/2013/05/temple-texas-to-build-cng-station-and-convert-solid-waste-fleet-to-natural-gas.aspx.
[30] Government Fleet. 2013. "Columbus to Place 18 CNG Automated Side Loaders Into Service by End of 2013." Available at: http://www.government-fleet.com/channel/fuel-management/news/story/2013/02/columbus-to-place-18-cng-automated-side-loaders-into-service-by-end-of-2013.aspx.
[31] Illinois Green Fleets. "Illinois Green Fleets." 2013. Available at: http://www.illinoisgreenfleets.org/green-fleets/fleets.html.

employers. Normal, Illinois, provides a leading example of municipal facilitation of energy efficiency through EVs. Normal has installed 37 Level 2 chargers for public use. Tesla Motors, a private manufacturer of all-EV vehicles, has installed four "superchargers" in Uptown Normal, as well.[32]

Themes from Nationwide Best Practices

In reviewing these examples, the CEC identified a number of themes that may be useful in helping local governments to identify when opportunities best exist related to the use of alternative fuels.

The first is that jurisdictions can pursue cost efficiency, energy efficiency, and potentially both, by using alternative fuel sources, and they do this depending upon their policy preferences and subsequent alternative fuel decisions. Because of this, jurisdictions tend to select alternative fuels for implementation based upon what alternative fuel options are appropriate to the needs of their current fleets and that minimize existing costs. Finally, case examples suggest that jurisdictions seldom pursue alternative fuel upgrades or conversions without outside funding incentives.

Potential Obstacles for the Use of Alternative Fuel Sources

Decision-Making Challenges

The first obstacle to implementation of alternative fuel use in local governments is understanding the type of alternative fuel that best fits their needs. The CEC has endeavored throughout this recommendation to provide information to assist in this decision-making process. To summarize a few of the most relevant points:

- The conversion of vehicles and installation of fueling stations in the case of propane is typically far more affordable than CNG conversion programs.
- The per-unit cost of CNG is typically lower than that of propane.
- Per BTU, or other unit of measure for energy, CNG is also typically more cost-effective and efficient.[33]

For communities wishing to convert all possible service fleets to alternative fuel sources, a mixed approach proves most effective. As upfront costs are cheaper for propane-fueled vehicles, best practice indicates that light-duty vehicles, such as police cruisers and public works pick-up trucks, are best served by propane conversions. These types of fleets are typically greater in number and have less likelihood of performing high performance activities such as hauling. However, bi-fuel conversion kits for existing vehicles, such as the Chevy Impalas generally used by the Sangamon County Sheriff's office, are not yet in existence in an approved, standardized form.[34] For heavy duty vehicles like transit or school buses and refuse service trucks, CNG proves a better option: these vehicles are popularly considered "gas guzzlers" and therefore require more fuel to function than a four-door sedan in use as a police vehicle.

[32] e-Town. "Public Charging." 2013. Available at: http://www.evtown.org/about-ev-town/ev-charging/public-charging.html.
[33] Propane 101. 2012. "Propane Vs. Natural Gas." Available at: http://www.propane101.com/propanevsnaturalgas.htm.
[34] Personal communication from Michael Long, SCSO Fleet Manager (August 14, 2013).

Decision-making related to alternative fuels is also made difficult by the volatile nature of fuel prices. With the potential for production increases in natural gas on the horizon, as well as the possibility for new or improved technologies related to ethanol, biofuels, and electric vehicles, substantial ambiguity meets local governments engaging in alternative fuel decision-making, Bi-fuel vehicles may provide additional opportunity for local fleets to adapt and respond to fuel price fluctuations in the future.

Range or Mileage

Another key issue for alternative fuel conversions is that of range. With the current technological state of propane- and CNG-fueled engines, traditional fuel engines remain superior in terms of range. Typically, propane vehicles have 85-90% the range of gasoline vehicles. This may be an issue particularly in fleets that are required to travel a longer range on a regular basis, yet do not have consistent fueling times or locations. CNG vehicles' range cannot be expressed in miles per gallon due to the compressed nature of the fuel. While CNG has less raw fuel efficiency than traditional fuels, CNG vehicles can have similar cost efficiency when fuel capacity is measured in gasoline gallon equivalents. Range limitations for CNG vehicles vary, and result from tank size and capacity constraints, which is why CNG is typically considered a fuel source better-fitted to large-scale vehicles with fixed routes.[35]

In the case of reduced mileage range capacity, communities researched by the CEC typically only employed conversions on vehicles which stay within an acceptable range of refueling stations: police cruisers, public works vehicles, or refuse collectors. As propane filling stations are more affordable to install, many propane-fueled fleet communities have invested in more than one filling station. Locally, filling stations are already available through some private sector entities.

Initial Capital Costs

Finally, the major and most notable drawback to the use of alternative fuel sources is the amount of upfront capital cost necessary to implement engine conversions in service fleets. These costs include not only the conversion or purchase of propane- or CNG-fueled engines, but also the installation of all necessary infrastructure, such as fueling stations. Particularly for entities that turn over fleet vehicles while at lower mileage, vehicle conversion may not prove cost-effective.

Many federal & state agencies have funding available in the form of grants, loan programs, and subsidies to offset the cost of converting municipal service fleets to alternative fuel sources. In most of the best practice cases described above, conversion programs were subsidized through incentive programs intended to increase fuel economy, reduce emissions, or reduce dependency on gasoline from foreign oil. Table 1, below, details some of the available incentives, rebates, and subsidy programs that may assist local governments in fleet conversions.

[35] Autogas for America. 2013. "Propane Autogas vs. Natural Gas." Available at: http://www.autogasforamerica.org/pdf/Autogas_vs_Natural_Gas_Share_Sheet.pdf.; Chad Osko. 2011. ""The MPG of an NGV." Available at: http://www.cngnow.com.

Table 1: Alternative Fuel Financial Incentives

Funding Source	Brief Description	Application Process	Caps/Limits	Additional Resources
Federal Alternative Fuel Excise Tax Credit	A tax incentive for alternative fuels that are sold for use of used as a fuel to operate a motor vehicle.	For alternative fuels sold between January 1, 2005 and December 31, 2013.	$0.50/gallon for CNG, propane.	http://www.afdc.energy.gov/laws/law/US/319
Federal Alternative Fuel Infrastructure Tax Credit	A tax incentive for CNG, propane, electricity, E85, and biodiesel infrastructure.	For consumers who purchased qualified fueling equipment prior to December 31, 2013.	30% of total cost; not to exceed $30,000.	http://www.afdc.energy.gov/laws/law/US/10513
Alternative Fuel Tax Exemption	A tax incentive for alternative fuels used in a motor vehicle for farming purposes, by non-profit education organizations, or for exclusive use by a state, political subdivision of a state.	For alternative fuels sold between January 1, 2005 and December 31, 2013.	Exemption from federal taxes on alternative fuels.	http://www.afdc.energy.gov/laws/law/US/397
Federal Tax Credit for Electric Vehicles	At time of purchase of an electric vehicle, tax credit information is transmitted from the dealer to the federal government, entitling the consumer to a tax credit.	No application; tax credit is applied during the proceeding tax season.	Up to $7,500, depending on vehicle make and model.	http://www.fueleconomy.gov/feg/taxevb.shtml
Federal Clean School Bus USA	Federal funding opportunity to replace or convert petroleum diesel school buses to biodiesel fleet buses.	Accessed through www.grants.gov, capital funding available through the Diesel Emissions Reduction Act (DERA).	Varies; appropriation amounts are determined by Congress annually.	http://www.epa.gov/cleanschoolbus/csb-overview.htm

Illinois DCEO Electric Vehicle Infrastructure Rebate Program	DCEO offers a rebate program which covers the installation of networked (public service, locatable by smart phone) and non-networked (private residence) Level 2 electric vehicle charging stations.	For electric vehicle charging stations installed after September 4, 2012.	Up to 50% of infrastructure costs, not to exceed $49,000. Caps include: $3,750 for a single, public station; $3,000 for a single, private station; $7,500 for a dual, public station; and $6,000 for a dual, private station.	http://www.ildceo.net/dceo/Bureaus/Energy_Recycling/ev.htm
Illinois Green Fleets Fuel and Conversion Rebate Program	The Illinois Green Fleets program includes rebates for the purchase of E85 and biodiesel, alternative fueled-vehicles (CNG, propane, electric, hydrogen, and certain E85 flex fuel models), and the conversion of vehicles to alternative fueled-engines (CNG, propane, or E85).	For fuel purchase, vehicle purchase, or vehicle conversion between January 1, 2012 and December 31, 2012.	Fuel: $340 for vehicles driven 17,500 miles or less; $450 for vehicles driven more than 17,500 miles. Vehicle Purchase: up to $4,000. Vehicle Conversion: 80% of conversion cost, up to $4,000.	http://www.illinoisgreenfleets.org/fuels/

Alternatives

Several options are available to communities within the county in relation to the use of alternative fuel sources in their service fleets. These alternatives include:

1. Maintain the status quo.
2. Expand or initiate vehicle-appropriate conversion programs in larger jurisdictions with more capacity within the county, such as the City of Springfield and Sangamon County.
3. Expand or initiate vehicle-appropriate conversion programs in jurisdictions across the county where access to existing alternative fuel filling stations is available.
4. Create a regional agreement between all jurisdictions in the county to mutually fund and use alternative fuel filling stations and convert all fleets to vehicle-appropriate alternative fuels.

Alternative 1— maintain the status quo— would avoid conversion and infrastructure installation costs at the city, village, township, and county levels. However, with rising gasoline prices, the cost of operating and maintaining municipal fleets is likely to continue rising, potentially proving this alternative unsustainable.

Alternative 2— expand or initiate appropriate conversion programs in larger jurisdictions within the county– would save fuel and maintenance costs for jurisdictions with the capacity to implement conversion programs. Using the filling stations already available in the area, larger initial capital infrastructure expenditures could be avoided. As programs expand, the likelihood of needing to expand or build new filling stations would increase. This alternative specifically targets larger jurisdictions in Sangamon County, because they more likely to be able to afford

the capital costs for fleet conversion, they are more likely to have a fleet size that leads to cost effectiveness for alternative fuel conversion efforts, and, in Sangamon County, they are generally the jurisdictions that are located nearer to the urban core of the county and the fueling stations already in place there.

Alternative 3— expand or initiate appropriate conversion programs across the county– would ultimately accrue all of the benefits of alternative fuels, such as fuel and maintenance cost reductions for any participating jurisdictions. However, expanding outward from larger jurisdictions in an individualized fashion may be cost prohibitive for smaller local governments. Therefore, this alternative employs an informal "hub-and-spokes" regional model. In such a model, existing conversion programs would offer administrative assistance to smaller jurisdictions looking to implement alternative fuel conversion programs, thereby increasing the overall effectiveness of alternative fuel programs in the region. All local jurisdictions would be encouraged to work together and to share expertise, in order to reduce the administrative burdens associated with gaining technical knowledge related to alternative fuels.

Alternative 4– create a regional agreement between all jurisdictions in the county to implement a county-wide alternative fuel program—would create maximum fuel and maintenance savings across the county by formalizing the relationships discussed in alternative three as part of a larger, regional capital program. Cost-sharing for county-wide infrastructure development would allow smaller jurisdictions take part in conversion programs otherwise outside of their capacity. Moreover, a formal agreement would allow for local governments to create cooperative capital plans for this purpose. These plans could incorporate the vehicle turnover needs encountered by local jurisdictions in their normal course of business, and allow for increased incorporation of alternative fuel vehicles in this replacement process. However, a formal, regional program may also lead to difficulties in terms of loss of local control over fueling stations and fleet conversion schedules.

Recommendations

In light of the research presented above, the CEC recommends that the larger jurisdictions within the county continue or initiate, as appropriate, alternative fuel conversion programs to their light-duty and heavy-duty fleet vehicles, particularly as normal vehicle turnover presents opportunities to do so. The CEC further recommends that jurisdictions research the viability of cooperative alternative fuels fleet conversions in order to minimize the up-front capital costs of alternative fuel conversion implementation.

The benefits of implementing the recommendation detailed above include:

- Reduced annual fuel costs per converted vehicle.
- Reduced annual maintenance costs per converted vehicle.
- Reduced environmentally harmful greenhouse gas emissions per converted vehicle.
- Potential increased ease of access and reduced up-front costs for jurisdictions engaged in alternative fuel conversions through cooperative use of existing fueling stations.
- Potential for cooperative efforts that utilize the expertise of more experienced jurisdictions.

The drawbacks of implementing the recommendation above include:

- Upfront costs are prohibitive for some jurisdictions, requiring outside financial assistance in the form of grants or loan programs from state and/or federal agencies.

- Educational and training programs are required to obtain certification for the installation and fueling of propane and CNG.

Steps toward Implementation

In order to implement this recommendation, the CEC recommends that the following initial course of action would be beneficial:

- Conduct further research into the viability of alternative fuel conversion programs across various jurisdictions, potentially with assistance from a regional body such as a mayor's caucus or leadership council.
- Initiate a dialogue with the SMTD about the potential for cooperative fueling station use.
- Begin a dialogue with the City of Springfield private businesses about the potential for cooperative use of the City's propane filling stations or other public-private partnerships.
- Investigate the federal and state funding sources identified in Table 1 for alternative fuel conversion programs.[36]
- Proceed with alternative fuel conversions as appropriate vehicle needs and funding sources align.

In order to implement the recommendation described above, the CEC also notes that proven forethought in the areas of capital planning and grant readiness are required of local jurisdictions, so that they have the capacity to take advantage of opportunities as they arise. The CEC supports capital planning efforts and grant preparedness in communities across the region, and notes that preemptive planning is an efficient way to prepare for funding opportunities which allow jurisdictions to realize their goals.

The CEC offers its support for these implementation efforts. If the CEC can provide any further assistance in facilitating efforts toward cooperation, it would be pleased to do so.

Respectfully submitted,

Hon. Karen Hasara, Chair
on behalf of the
Citizens' Efficiency Commission
for Sangamon County

[36] This list is not comprehensive, but rather represents a preliminary overview of funding alternatives for fuel conversion programs.